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LAKE AND STREAM INVESTIGATIONS

Gary Pearse, Michael Kramer, Richard Peckham

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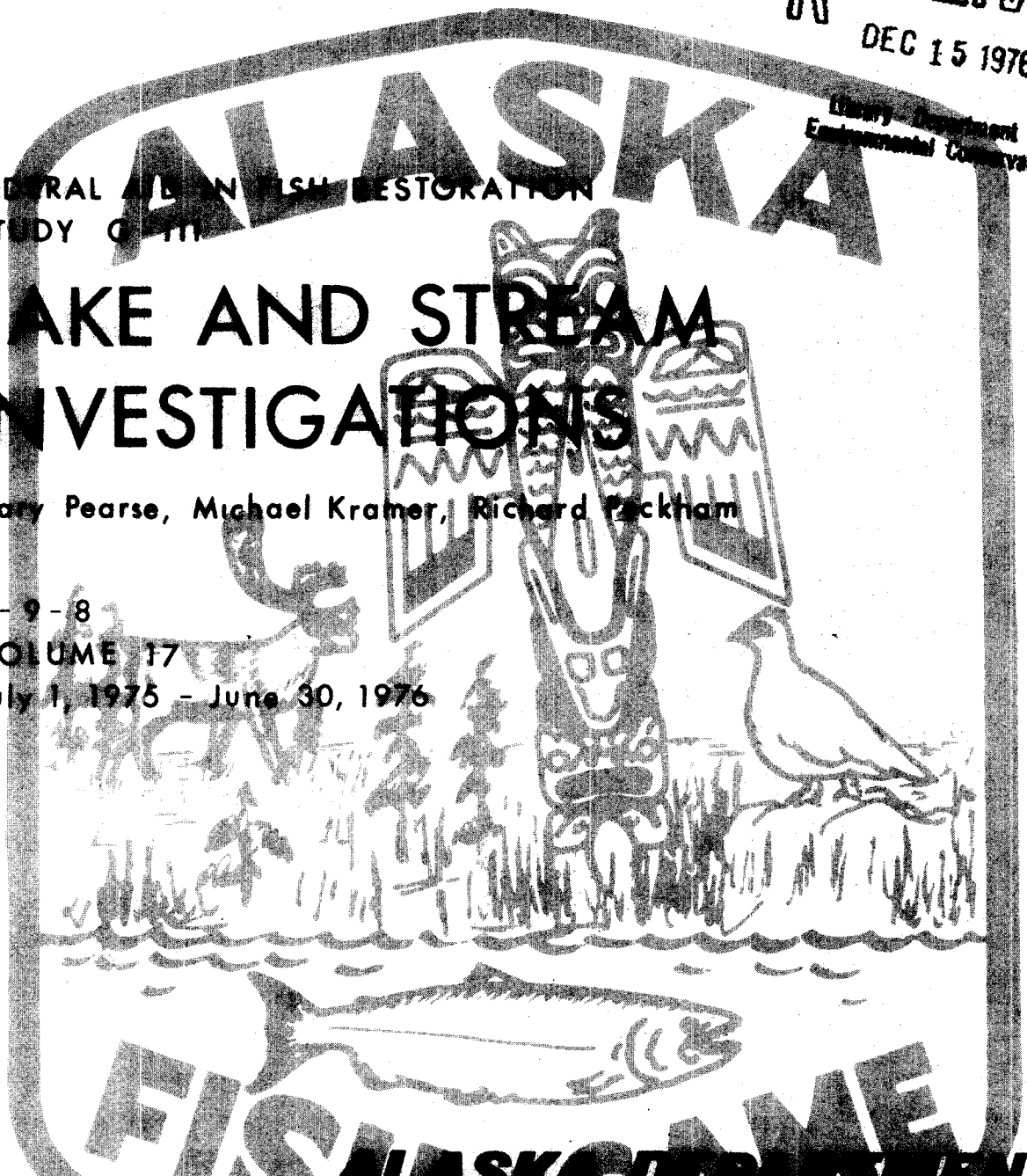

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Volume 17 Study G-III

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

LAKE AND STREAM INVESTIGATIONS INTERIOR ALASKA

by

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RESEARCH PROJECT SEGMENT

State:	Alaska	Name:	Sport Fish Investigations of Alaska.
Project No.:	F-9-8		
Study No.:	G-III	Study Title:	LAKE AND STREAM INVESTIGATIONS
Job No.:	G-III-G	Job Title:	Study of Typical Spring-fed Streams of Interior Alaska

Period Covered: July 1, 1975 to June 30, 1976.

ABSTRACT

Data collected during 1975 regarding Arctic grayling, Thymallus arcticus (Pallas), and round whitefish, Prosopium cylindraceum (Pallas), index sampling is presented. Age V and VI grayling predominated and each comprised 33% of the 63 taken in a single index run. The number of grayling taken in 1975 is 67% of that taken on a similar run in 1973. Round whitefish capture rates equaled 77% of the 1973 sample.

Lengths of grayling taken in 1975 were slightly less than those sampled in 1973 at the same age. In the period 1960 to 1966, grayling less than 264 mm predominated. From 1973 on, fish greater than 265 mm were most abundant in the sample.

Grayling fry were directly introduced into spring areas in the Delta Clearwater River but none were recaptured. Fry placed in three shallow ponds on Ft. Greely attained a length of 115 mm and averaged 32 per pound in 14 weeks. Over 9,100 were restocked in spring areas in the Delta Clearwater River, equaling a minimum pond recovery of 18.2% of the original plants. Three fyke nets fished for two days captured an estimated 99% of the fish in one pond.

Methods for round whitefish capture in order to reduce competition with grayling, were investigated and recommendations for their management are discussed.

BACKGROUND

Studies of Interior Alaskan spring-fed streams were initiated in 1952 by the United States Fish and Wildlife Service as part of an Arctic grayling, Thymallus arcticus, life history study. From 1952 to 1958, these studies were conducted on age and growth, migration, food, and spawning habits of grayling. Emphasis was placed on the migration habits of grayling within the Tanana River watershed and on the development of various tagging techniques. Results of these studies were presented as Quarterly Progress Reports of Federal Aid in Fish Restoration, F-I-R-I to F-I-R-8.

With the advent of statehood and management of these resources by state personnel in 1959, studies on the Delta Clearwater and nearby river systems were continued with emphasis on the determination of stocks, migration patterns (intrastream and interstream), and angler success. These investigations have been conducted intermittently until the present, with results published in the Annual Department of Fish and Game Federal Aid in Fish Restoration Reports.

An intensive study was begun in the fall of 1972 to bring to date information on the status of fish species present in the Delta and Richardson Clearwater rivers and other spring-fed systems in the Tanana drainage (Fig. 1).

The Delta Clearwater River, the main stream studied, is situated approximately 13 km (8 mi) northeast of Delta Junction (Fig. 2). This river provides an extremely popular summer sport fishery for Arctic grayling. Access is either through two roads which branch off the Alaska or Richardson highways or up the Tanana River from Big Delta. The Delta Clearwater River drains an area of approximately 350 square miles, drawing heavily on groundwater as its source. Fairly constant levels, flows, and water temperatures characterize this and other Interior Alaskan spring-fed systems.

The results of the above investigations were discussed by Pearse (1974). Briefly, data collected for the Delta Clearwater River during that study showed that water temperatures ranged from 0.5°C to 8.5°C. Water levels remained fairly constant, to be varied by backup from the Tanana River or ice jams during severe cold spells in winter months. High levels of hardness (188 ppm) and alkalinity (171 ppm) were recorded. The main fish species present are Arctic grayling, round whitefish, Prosopium cylindraceum, and silver salmon, Oncorhynchus kisutch (Walbaum). The presence of humpback whitefish, Coregonus pidschian (Gmelin), least cisco, C. sardinella (Valenciennes), longnose sucker, Catostomus catostomus (Forster), slimy sculpin, Cottus cognatus Richardson, chum salmon, Oncorhynchus keta (Walbaum), and burbot, Lota lota (Linnaeus), was also confirmed.

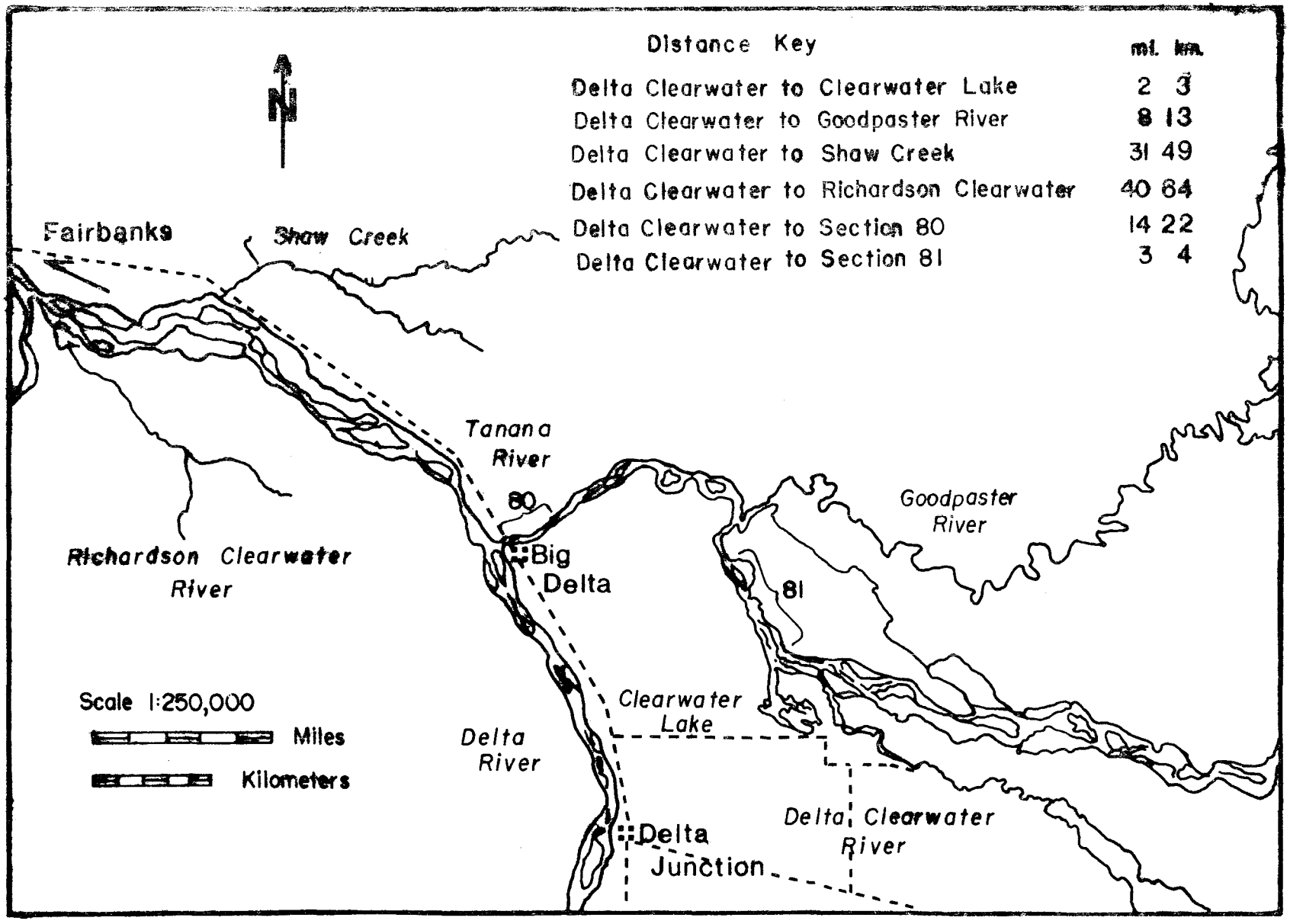

FIGURE 1. TANANA - CLEARWATER STUDY AREA

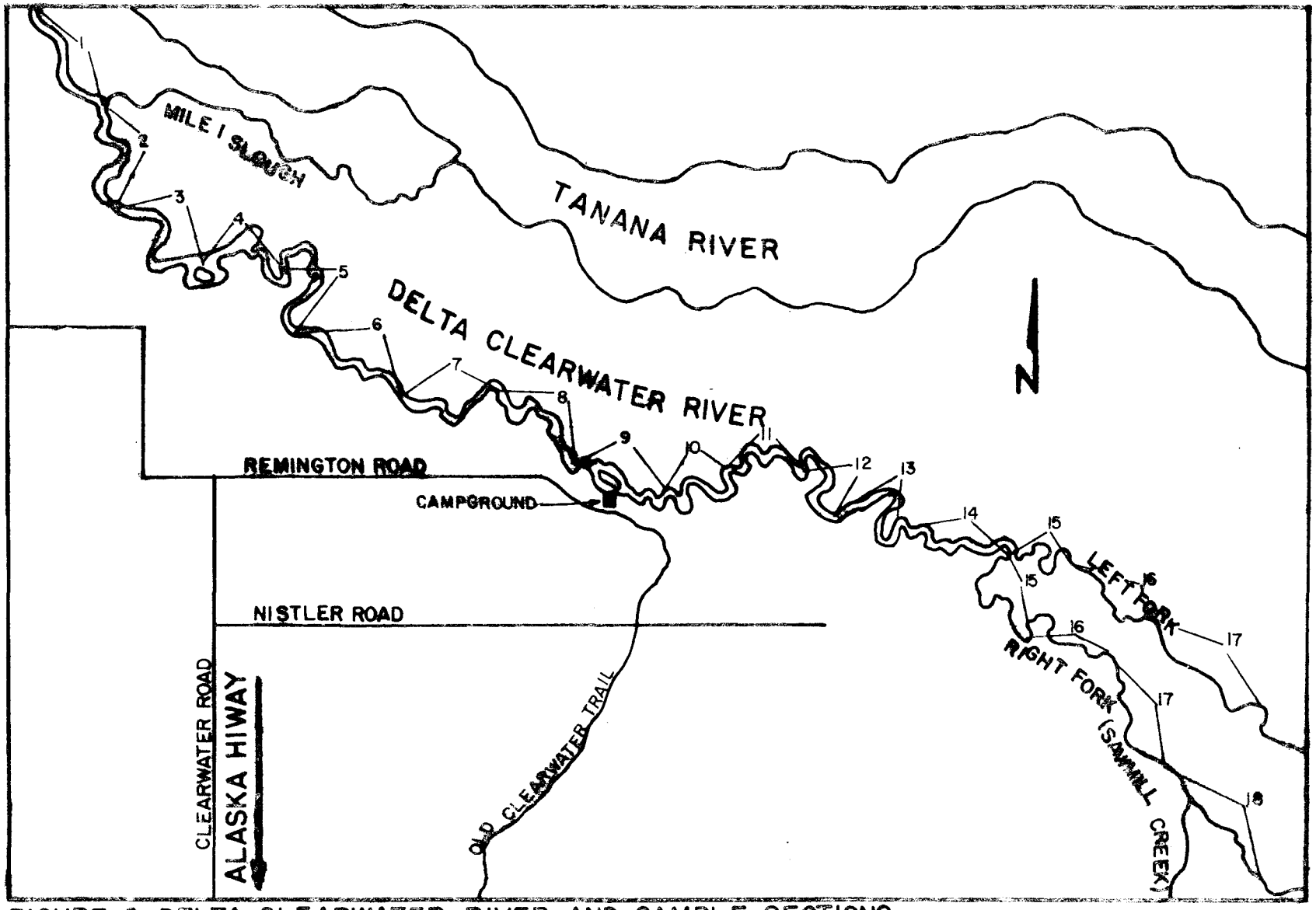

FIGURE 2. DELTA CLEARWATER RIVER AND SAMPLE SECTIONS

Standing crop estimates showed 6.7 kg per hectare for grayling and 56.9 kg for round whitefish. Estimates of abundance indicated 2,267 grayling and 13,611 round whitefish to be present. Over 5,000 silver salmon spawn annually in this system.

Life history information regarding length frequencies and distribution, length-weight relationships, condition factors, age and sex composition, and maturity for Arctic grayling and round whitefish was also presented.

The study was discontinued from 1974 until 1975, when life history information was again collected and a portion of the above data updated.

The present study is directed towards the monitoring of existing fish stocks in the Delta Clearwater River. The feasibility of displacing round whitefish and its effect on interspecific competition will be investigated. In addition, the impact of enhancing existing grayling stocks through the planting of pond reared fingerlings will be evaluated.

RECOMMENDATIONS

1. Continue the index sampling of Arctic grayling and round whitefish in the Delta Clearwater River and nearby systems.

2. Emphasize a creel census program for grayling population monitoring in the Delta Clearwater River and nearby systems.

3. Continue the experimental program of pond rearing and transplants of Arctic grayling to the Delta Clearwater River.

4. Reopen the subsistence fishing for round whitefish in the Delta Clearwater River and other suitable locations.

5. Determine the fall distribution and spawning habits of round whitefish in the Delta Junction area.

OBJECTIVES

1. Monitor existing stocks of Arctic grayling and whitefish in the Delta Clearwater River.

2. Continue enhancement of grayling stocks in the Delta Clearwater River.

3. Determine the feasibility of various techniques controlling competition between grayling and round whitefish in the Delta Clear water River.

TECHNIQUES USED

To obtain continuing estimates of relative abundance, index sections previously established (Fig. 2) were used as a sampling guideline. Each section is one statute stream mile in length. Fish species studied for relative abundance and age-length frequencies were captured by an alternating current shocker boat described by Van Hulle (1968) and Roguski and Winslow (1969). The sampling procedure consisted of a single downstream run, one section at a time, during which both grayling and round whitefish were captured. Scale samples and length data were taken from all grayling, and both species were released within the section where captured.

Fish scales used for aging were cleaned, mounted between glass slides, and read with the use of an overhead projector. Readings were taken along the dorsal scale field.

To determine the stocking success of grayling fry introduced to stream spring areas or rearing ponds, either a back-pack mounted pulsed DC electroshocker or 50' fine mesh seine was used for monthly sampling. Fish so captured were first weighed live then preserved in 10% Formalin and later autopsied for length, weight and age data. During the transplant from the Ft. Greely rearing ponds to the Delta Clearwater River, both fyke nets and bag seines were used, the former being the most efficient. The captured grayling were transported to the stream in a pickup-mounted water tank.

Round whitefish were captured most effectively by fyke nets in the lower Clearwater. They were then transported to distant locations by riverboat.

FINDINGS

Monitoring of Arctic Grayling and Round Whitefish Stocks

Data on stock composition and relative abundance was collected in a similar manner to that used in 1973. That method uses a riverboat equipped with AC electroshocker gear. Fish stunned by this method are dipped from the water and when recovered, fork length measurement and scales for aging are taken.

The age composition and observed length-age relationships of 63 Arctic grayling, the total taken during one sample run down the Delta Clearwater River during 1975, are presented in Table 1. Ages V and VI predominate and each comprises 33% of the total. In the age comparison for 237 grayling taken in 1973, ages IV and VI were the most abundant. Arctic grayling older than Age VI, generally the oldest age at which they mature, (Tack 1974), show up in reduced numbers. Grayling younger than Age IV were absent in the 1975 sample.

Table 1. Age composition and observed length-age relationships of 63 Arctic grayling electrofished in the Delta Clearwater River, 1975.

Fork Length (mm)	Age										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
240-259	...	...	...	1	1	...	...	...	...	...	...
260-279	...	...	...	3	4	1	...	...	...	...	...
280-299	...	...	...	3	4	2	...	...	...	...	...
300-319	...	...	...	...	10	6	...	...	...	...	...
320-339	...	...	...	...	2	7	2	...	...	...	...
340-359	...	...	...	...	...	4	3	...	1	...	...
360-379	...	...	...	...	...	1	3	...	...	...	...
380-399	...	...	...	...	...	...	1	2	...	...	...
400-419	...	...	...	...	...	...	...	1	1	...	...
No. of Fish	...	...	...	7	21	21	9	3	2	...	...
Age Comp. (% 1975)	...	...	...	11	33	33	14	5	4	...	...
Age Comp. (% 1973)	1	2	17	22	16	24	13	4	0	0.5	0.5
Mean Length(mm) 1975	...	...	...	270	297	331	355	396	378	...	...
S.D.	...	...	...	14	23	24	21	21	40	...	...
Mean Length(mm) 1973	115	160	222	268	311	346	366	402	...	456	425
S.D.	6	19	24	26	23	22	25	29	...	...	...

Length comparisons of grayling taken in 1973 and 1975 at the same yearly time and in the same sections are also shown in Table 1. Lengths of fish taken in 1975 were slightly less than those taken in 1973 at the same age.

Table 2 compares the length frequency of Arctic grayling taken since 1960 in the Delta Clearwater River. In the years from 1960 to 1973 the strong length groups varied from year to year, with the 215-264 mm (8.5-10.5") predominating on the average. Compared with the 1975 data, there were more fish in the sample under 264 mm (10.5") during the 1960 to 1973 period. However, as in 1973, the 1975 sample had a higher percentage of fish larger than 315 mm (12.5"). No detailed analysis of size selectivity due to the sampling method is available in this system. Fish of size 150 mm and larger are commonly taken by electrofishing where they occur, such as in the Chena and Goodpaster rivers. In the years prior to 1973, fish were sampled with hook and line as compared to the shocker boat now used. Visual observations often indicated fish presence when electroshocking proved unsuccessful.

No weight versus length data were taken in 1975, but this relationship would be expected to compare closely with that measured in 1973.

Figure 2 shows the Delta Clearwater River and the sections in which both grayling and round whitefish were sampled. The results of capture numbers for both species during a single downstream run are shown in Table 3. The number of grayling taken in 1975 is 67% of that taken on a similar run in 1973. The number captured in section 17 was higher in 1975, but was generally lower in the remaining sections. Round whitefish capture rates were also down and equaled 77% of those taken in a like manner during 1973. Fewer whitefish were captured in the lower sections in 1975 than in 1973. The river widens and slows below section 15 making the capture method less efficient and estimates of relative abundance by section more variable. Use of the totals, however, should yield relative abundance estimates.

Attempts were made to visually estimate relative numbers of both whitefish and grayling during 1975. The results showed extreme variability between repeated runs through the same sections. This, coupled with the difficulty of separating small fish by species, marked this method as the least reliable.

Angler harvest during 1975 was not monitored sufficiently to give data directly comparable to data collected in past years. The general trend continued that good fishermen were able to catch their limit, which in the Tanana drainage was reduced from ten to five per day in 1975.

Numerous tags, recovered during the last two years since the initial tagging of both grayling and whitefish, were filed and long term results of this program will be reported in the completion report.

Table 2. Length frequency of Arctic grayling captured in the Delta Clearwater River, 1960-1975.

Length Class (mm)	1960 %	1961 %	1962 %	1963 %	1964 %	1965 %	1966 %	1973 %	1975 %	Mean % 1960-1973
165-214	20.0	19.0	34.0	10.0	29.0	21.0	18.0	7.0	...	21.0
215-264	44.0	33.0	50.0	32.0	26.0	34.0	58.0	22.0	6.0	41.0
265-314	27.0	23.0	11.0	39.0	27.0	32.0	20.0	19.0	40.0	24.0
315-364	8.0	21.0	4.0	14.0	13.0	9.0	4.0	33.0	41.0	11.0
365-414	1.0	3.0	1.0	4.0	5.0	4.0	1.0	16.0	11.0	3.0
415-464	0.05	1.0	...	1.0	1.0	...	...	3.0	2.0	0.2
No. Fish	2,094	320	1,086	491	362	281	386	413	63	5,496

Table 3. Relative capture rates per section for Arctic grayling and round whitefish, Delta Clearwater River, 1973 and 1975.

River Section	Grayling		Round Whitefish	
	6/27/73	7/2/75	5/18/73	7/2/75
17	25	36	48	142
16	10	1	28	21
15	22	5	22	76
14	9	1	65	0
13	8	3	14	65
12	0	0	34	0
11	2	3	16	21
10	3	0	52	16
9	2	0	14	0
8	5	2	29	15
7	4	4	48	0
6	1	2	34	0
5	2	6	33	27
4	0	1	33	10
3	2	0	29	0
2	0	0	12	0
1	0	0	0	0
Totals	95	64	511	393

Grayling Stock Enhancement

Experimental introduction of grayling in selected areas of the Delta Clearwater River as a means of stock enhancement was again undertaken in 1975. The locations chosen in 1975 were all spring areas, whereas in 1974, 100,000 fry were placed in the open river and 200,000 in nearby Clearwater Lake.

In the first phase, approximately 100,000 grayling fry were stocked in four spring areas on June 26, 1975. Each spring was stocked with approximately 25,000 grayling. Temperatures ranged from 2.2°C to 4°C at the time of stocking. Although allowed to acclimate for several minutes in each spring, all fry stocked showed some sign of thermal stress for up to twenty minutes. The springs are inhabited with rearing silver salmon of Age Classes 0 and I. Subsequent sampling with a back-pack shocker and seines failed to turn up any grayling stocked in 1974 or 1975. This stocking method appears to yield poor results and should be discontinued.

The second phase involved selecting three small lakes on nearby Ft. Greely for stocking with fry from the same batch as above. The three ponds averaged 4 to 6 surface hectares in size.

Pond #1 is approximately 4 surface hectares (10 acres) in size and has a maximum depth of 7 m (23'). The bottom is mostly rocky with little soft debris. A small weedbed occupies one corner. Water temperatures varied from 10°C at the time of stocking on June 26 to a high of 18°C on July 16. Water chemistry taken on July 16 was as follows: DO 6 ppm, CO_2 10 ppm, pH 9.5, hardness 34 ppm and alkalinity 51 ppm. A few small, resident slimy sculpins were the only indigenous fish species captured. The lake was stocked on June 26 with approximately 25,000 newly hatched grayling fry. As shown in Table 4, a month later they grew to an average 41 mm and weighed a little over 1 gm after preservation. In late July they had commenced active surface feeding. By the August sample, they averaged 74.9 mm and 5.2 gm. There were no subsequent samples taken. Due to the apparent ability of this pond to overwinter sculpin, this pond will be netted when the ice melts in early summer 1976, and any remaining grayling captured will be transferred to suitable habitat.

The second pond stocked, #2, is approximately 6 surface hectares (15 acres) and has a flat bottom and maximum depth of 1.5 m (5'). The bottom composition is rocky on the north end, and soft and weedy on the south. The water is humic stained. The temperature at stocking on June 26 was 12°C rose to 19°C on July 16, and later fell to 6°C in early October. This lake undergoes oxygen depletion in late winter. Water chemistry taken on July 16 was as follows: DO 8 ppm, CO_2 10 ppm, pH 8.0, hardness 51 ppm and alkalinity 51 ppm. Approximately 25,000 grayling fry were placed in this pond on June 26; no resident fish species were found. As shown in Table 4, in a month the grayling were 48 mm long and weighed 1.6 gm after preservation and were 93.8 mm and 10.2 gm by August 28. When finally sampled in early October, they averaged 108 mm and weighed 12.9 gm. This was equivalent to 33 to the pound live weight.

Table 4. Mean fork lengths, weights and condition factors of pond reared Arctic grayling, 1975.

Location	Sample Date	Fork Length(mm) $\bar{x}\pm SD,n$	% Increase	Weight(gm) $\bar{x}\pm SD,n$	% Increase	Condition Factor
Pond #1	July 25	41.3 ±5.04,5	...	1.02±0.38,5	...	1.45
	Aug 28	74.9 ±3.64,5	83%	5.20±0.76,5	400%	1.24
Pond #2	July 25	48.00±0.00,5	...	1.60±0.12,5	...	1.45
	Aug 28	93.8 ±1.64,5	95%	10.2 ±0.45,5	440%	1.24
	Oct 02	108.0 ±4.24,5	15%	12.9 ±1.29,5	26%	1.02
Left OP L.	July 25	51.4 ±2.61,5	...	2.14±0.19,5	...	1.58
	Aug 28	98.8 ±2.49,5	92%	11.9 ±0.89,5	460%	1.23
	Oct 02	115.0 ±4.16,10	16%	16.8 ±1.48,10	41%	1.10

The third pond, Left OP Lake, is also approximately 6 surface hectares (15 acres) in size and is 5 m (17') deep. The shore is rocky with areas of soft bottom present. Temperatures ranged from 14° C, when stocked on June 26, to 21°C, on July 16, and fell to 6°C in early October. Water chemistry was as follows: DO 6 ppm, CO^2 10 ppm, pH 8.5, hardness 86 pmm, and alkalinity 68 ppm. The water took on a yellowish color as the summer progressed, presumably from plankton, with visibilities limited to approximately 0.3 m. This lake has dried up considerably in recent years, and although past fish stockings have been successful, winter oxygen depletions have recently limited its overwintering ability. Approximately 25,000 grayling fry were stocked on June 26 and showed the best subsequent growth of the three ponds. The grayling averaged 51.4 mm and 2+ gm by July 25; and 98.8 mm and 11.9 gm by August 28 (Table 4). When last sampled in early October they averaged 115 mm and 16.8 gm. and were 32 to the pound when weighed live.

The condition factors (k) for fish in all three ponds declined throughout the summer from the time of first sampling. Fish in Left OP Lake had the highest condition factor, ranging from 1.58 a month after stocking to 1.10 at the time of removal in early October. This last value agrees closely with the value of 1.091 calculated by Pearse (1973) for stream grayling of similar length in the Delta Clearwater River.

The greatest percentage length increase occurred in Pond #2 (Table 4) with a 95% increase in the second month of growth. The greatest weight increase occurred in Left OP Lake with a 460% growth in the second month. Although preserved weight differed from live weight, the value of the relative increase should be unaffected.

After three months of growth the grayling fingerlings in Pond #2 and Left OP Lake were captured in early October and transferred to the Delta Clearwater River. The fish were left in the ponds this late to lessen the effect of thermal stress from the cold spring areas. Initial capture methods in Pond #2 involved the use of beach seines. Over 300 grayling were caught in one haul, with catches dropping to 150 total for the last two hauls. A single fyke net then set overnight caught over 3,000 grayling. A little over 200 were caught in the net the second night. An estimated total of 3,700 grayling, averaging 33/lb., were captured in Pond #2 and transfered via live tank to two spring areas in the Delta Clearwater River. This gave a minimum estimated survival in Pond #2 of 15% of the 25,000 fry originally stocked. An unknown number of fingerlings remained in the pond.

To get a better estimate of fyke neeting efficiency and survival in Left OP Lake, 370 grayling fingerlings were captured, marked by fin clipping, and released. Three fyke nets were then set for two days, with the majority of grayling being caught the first night. Five hundred of the grayling captured were examined for marks and 34 had been clipped. Using the Peterson mark-recapture population estimation method, an estimated 5,441 grayling were present at the start of the netting. This gave a minimum survival of 22% of the initial 25,000 stocked fry. The live fish

averaged 32/lb. A total of 168.5 lbs of fish was caught which equates to 5,392 fish captured by two days' setting, an estimated 99% of those present. These grayling were also transferred to the Delta Clearwater River and stocked in two spring areas, bringing the total transferred to approximately 9,100.

Future analysis of stream survival and separation from native grayling could be accomplished through scale examination. At the date of stream stocking, October 2, 1975, the pond reared grayling scales averaged 14 circuli $\pm$ 0.98 and ranged from 13 to 16 circuli. An examination of 52 grayling scale samples collected from the Delta Clearwater River this last season showed that the scales averaged 8.7 circuli $\pm$ 2.06 and ranged from 5 to 14 circuli to and including the first annulus. The stocked grayling can be expected to have more circuli before the annulus is formed in the spring of 1976. Thus, fish having a high circuli count to the first annulus and of the proper age could be expected to have come from the enhancement program.

Round Whitefish Investigations

During April, 1975, attempts were made to determine the best methods and areas of capture for round whitefish. It has been proposed that this species competes for food and space with Arctic grayling and that a reduction in whitefish numbers may be desirable and beneficial to the grayling.

In past years there was a somewhat popular subsistence fishery for the whitefish in the Mile One slough area (Fig. 2). This fishery probably kept the whitefish in check. The fishery was closed in 1972 to permit the detailed population analysis described by Pearse, 1973. The primary subsistence tools were gill nets, and due to the mesh size requirements, few grayling were incidently taken. Adult grayling (over 270 mm) are not present in the river until mid-May. Due to their proven past success, gill nets were not used in this study.

Seines would make a successful capture tool only if the whitefish could be concentrated and, hence, are inefficient in the open river with a soft bottom. Their past use has been minimal and limited to specific areas.

Fyke nets hold a good promise as a capture tool. The fish are alive when the net is checked and can easily be transported to other areas. The location for net setting depends on slow current, and the more river width fished the better.

Shocker boats are effective in turbid waters or those narrow and fast enough to make avoidance by fish difficult. The captured fish recover and can be used for consumption or transported to other locations. The use of shocker boats by the general public is, however, prohibited.

The 1975 study concentrated on placing a fyke net across Mile One Slough where some whitefish congregate before moving further up the main Delta Clearwater River. In two days of fishing, the net caught approximately

1,200 round whitefish. These whitefish were then transported to another location. The index counts in 1975 described above showed a 23% decrease in round whitefish numbers compared to 1973. Whether this was due to the above displacement is not known.

Discussion

Population Analysis:

As explained in the background section and discussed in the findings, attempts at population analysis have been conducted by various workers over the past 23 years in these clearwater streams. Condensed, the results indicate that little whitefish or grayling reproduction takes place in these systems and, hence, we have attempted to delineate stocks through tagging and subsequent recapture. If great enough numbers live, reproduce or migrate as a group, then the traditional stock concept can be said to apply. Past tagging results indicate a movement from the known grayling spawning streams, such as the Chena River, Tangle Lakes, Shaw Creek, and the Goodpaster River to the Five Mile, Richardson, and Delta Clearwater spring-fed systems. These spawning streams possess summer and winter populations of their own and are also fished heavily by local anglers.

Past tagging results have shown that some grayling return to these clearwater streams yearly while others arrive through distant migrations on a seemingly random basis. Thus, those fish present in the clearwater streams are a composite of migrants from among many spawning systems and comprise more than a single stock. Any mixed stock fishery has its management problems compounded by variation in numbers of its member stocks, especially when their distinctiveness is poorly defined.

The real problem in population analysis and management of grayling and whitefish in the spring-fed systems lies not in data collection, but in assigning to those data the causes for variation in numbers and age composition.

A poor year class in a distant spawning stream, an intensive summer fishery there, or a failure to migrate as in past years may lead to unpredictably reduced numbers or size variances in the clearwater system. It may well be that, years ago, unexploited populations in these clear-fed streams comprised a single stock as usually defined. Exploitation may have reduced their numbers and opened the prime habitat in the stream to new migrants, but this is only speculation.

What we now have are popular summer fisheries to maintain with limited population data. Maintaining good spawning runs and adult age classes is essential as is monitoring the grayling catch in the summer fisheries. A program of population sampling in index areas as well as creel census to determine what segments of that population are harvested should yield workable data indicating what trends are present in both the spawning and summer grayling fisheries. The determination of stock status would be

best undertaken by studying a system small enough to permit the total collection and manipulation of the fish present and then applying the data to larger systems with similar characteristics.

Grayling Enhancement:

While the direct stocking of grayling fry seems to hold little promise as an enhancement method, fingerlings reared to a competitive size show the best promise as a means of supplementing fisheries in spring-fed systems. The expense for such a project is minimal and at the 20% survival rate sufficient numbers can be stocked. The success of this project hinges on whether or not these grayling survive well, and if so, choose to remain in the areas where planted. The total stocked this fall in the Delta Clearwater River (9,100) far exceeds the total population estimated for this river in 1973 (2,267). With continued stocking and adequate survival, their impact should be felt within the projected study period and may divert some pressure from resident grayling populations. Imprinting of these fish would be the ideal result. As discussed above, scale analysis and circuli counts should enable us to evaluate their survival and effect on the fishery.

Whitefish Studies:

Based on estimates taken in 1973, round whitefish outnumber Arctic grayling in the Delta Clearwater River six to one. Large numbers are also present in the Richardson Clearwater River and the Tanana River drainage in general. Their effect on grayling in competition for food and space in these spring-fed systems is questionable. Both species are in good condition and can be found occupying the same feeding areas at the present population levels. Neither show visible effects of the other's presence. Competition is likely to occur, however, after hatching and during the rearing period. For example, both species spawn, rear, and possibly compete in the Goodpaster River. Other areas of whitefish spawning are poorly known and should be investigated. Thus, the reduction in round whitefish numbers may lessen the population's reproductive capacity and ease rearing competition with grayling. Displacement would probably not achieve this goal unless it covered an extremely large distance.

Attempts to develop a sport fishery for round whitefish have met with little success. Presently, the best way to utilize whitefish and at the same time possibly reduce competition would be to reopen the spring subsistence fisheries to the general public. Other subsistence fisheries could be developed in areas where incidental catches of sport fish could be minimized.

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